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LOWELL OBSERVATORY

Flagstaff, Arizona

FINAL REPORT

On

STUDIES ON THE ORBIT OF PLUTO

Contract No. Nonr-411(00)

**LOWELL OBSERVATORY
Flagstaff, Arizona**

FINAL REPORT

**On
STUDIES ON THE ORBIT OF PLUTO**

**By
C. O. Lampland
and
H. L. Gielas**

Prepared Under U. S. Navy Contract No. Nonr-411(00)

STUDIES ON THE ORBIT OF PLUTO

The object of this investigation and as set forth in the specification of work is to provide accurate positions of the outermost planet Pluto from the very extensive and thorough collection of observations of this planet made at the Lowell Observatory. These measures will be related to the Fundamental positions of bright reference stars, and a new definitive orbit may then be computed on the same fundamental system as the other planets.

The photographic plates which represent the observational material were secured by the late Dr. C. O. Lampland at the Newtonian focus of the 42-inch Lowell reflector. This is one of the most systematic and homogeneous series of observations available at any observatory, and dates from the discovery of Pluto on January 23, 1930 at this observatory.

The measurement of these plates, while the specific concern of this contract, is a part of a much larger cooperative undertaking by several major observatories. As the planet Pluto is somewhat fainter than magnitude 15, and the stars used as the basis for the Fundamental reference standards of position are measured by meridian transit telescopes and are usually brighter than magnitude 10, the ultimate reference of Pluto to these brighter fundamental stars must be made by intermediate stars to minimize or eliminate errors due to the magnitude difference.

The full cooperative procedure is as follows: Stars brighter by a magnitude and a half than Pluto are selected symmetrically about its image on each plate and the rectangular coordinates measured. The identity of these comparison stars are transferred to plates taken along the apparent path of motion of the planet with the 20-inch Carnegie Astrograph of the Lick Observatory. These large field plates in turn will be measured on the large measuring engine at the Yale University Observatory in order to refer

these stars into a group of tertiary standards of the Yale re-observation of the *Astronomisches Gesellschaft* catalog. These stars are finally referred to the fundamental FK 2 catalog or its revision to which the U. S. Naval Observatory has contributed special meridian positions.

The measurement of the plates under this program was begun by Dr. C. O. Lampland in July 1951. In addition to the selection, measurement, and preparation in suitable form for transmittal of the rectangular coordinates of Plate with respect to the comparison stars as mentioned earlier in the report, copies of the plates were made and sent to the Yale University Observatory for positive identification of the selected stars on the large field plates. These measurements were carried as far as the opposition of 1934-1935 before Dr. Lampland's death in December 1951. Over a year later this work was resumed by Mr. H. L. Gielas of the Lowell Observatory staff who completed, checked and prepared the balance of the 1935 measurements for transmittal. Following this, a cooperative agreement was consummated whereby the plates were selected, the object identified, and the data placed on them at the Lowell Observatory. The plates were then shipped to the Yerkes Observatory where the measurements were made by Dr. G. Van Riebroeck. The plates were then returned to the Lowell Observatory files.

In all, a total of 336 plates have been measured under the support of this program. All the measurements have now been completed, and the data has been sent to the Yale University Observatory for incorporation into the other phases of this program.

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